

Amendments to the Claims:

The following listing of claims will replace all prior versions, and listings, of claims in the application:

31. (Currently Amended) A photomask blank forming a thin film having a shading function and containing one or more transition metals or compounds thereof on a transparent substrate,

wherein the thin film restrains a film stress to be small by containing He, and

wherein the content of He in the thin film is in a range of a film stress that the amount of change in flatness degree expressed by the difference in flatness degree between an initial value of the flatness degree which is the flatness degree of the transparent substrate when the thin film is not formed on the surface thereof and the flatness degree when the thin film is formed on the transparent substrate is equal to or less than $-2 \mu\text{m}$ or less.

32. (Currently Amended) A photomask blank forming a thin film having a shading function and containing one or more transition metals or compounds thereof on a transparent substrate,

wherein the thin film is formed by sputtering in which a sputtering target is disposed in a vacuum chamber into which an atmosphere gas has been introduced,

the He gas content is 30 to 90 vol% in the atmosphere gas,

the sputter target contains one or more transition metals or compounds thereof, and

the formation of said thin film is conducted at a thin film a-deposition rate in a manner that a particle occurrence frequency dependent on the thin film deposition rate is restrained so that the production yield rate dependent on the particle occurrence frequency is within toleranceduring the film formation by the sputtering is 0.5 nm/sec to 6 nm/sec.

33. (Previously Presented) The photomask blank according to claim 31, wherein the thin film contains one or both of carbon or oxygen in addition to the one or more transition metals or compounds thereof.

34. (Previously Presented) The photomask blank according to claim 32, wherein the thin film contains one or both of carbon or oxygen in addition to the one or more transition metals or compounds thereof.

35. (Previously Presented) The photomask blank according to claim 33, wherein the thin film is a laminated film comprising the shading layer containing one or more of the transition metals or compounds thereof, He and carbon, and an anti-reflective layer containing one or more of the transition metals or compounds thereof and oxygen.

36. (Previously Presented) The photomask blank according to claim 34, wherein the thin film is a laminated film comprising the shading layer containing one or more of the transition metals or compounds thereof, He and carbon, and an anti-reflective layer containing one or more of the transition metals or compounds thereof and oxygen.

37. (Previously Presented) The photomask blank according to claim 35, wherein the thin film has an oxygen content that continuously decreases and a carbon content that continuously increases from the thin film surface side to the transparent substrate side.


38. (Previously Presented) The photomask blank according to claim 36, wherein the thin film has an oxygen content that continuously decreases and a carbon content that continuously increases from the thin film surface side to the transparent substrate side.

39. (Previously Presented) The photomask blank according to claim 35, wherein the carbon content is 0 to 25 atomic% and the oxygen content is 0 to 70 atomic%.

40. (Previously Presented) The photomask blank according to claim 36, wherein the carbon content is 0 to 25 atomic% and the oxygen content is 0 to 70 atomic%.

41. (Previously Presented) The photomask blank according to claim 33, wherein the thin film further contains nitrogen.

42. (Previously Presented) The photomask blank according to claim 34, wherein the thin film further contains nitrogen.

43. (Previously Presented) The photomask blank according to claim 31, wherein the thin film has a crystal grain size of 1 to 7 nm. 

44. (Previously Presented) The photomask blank according to claim 41, wherein a nitride film containing nitrogen and the same transition metal or metals contained in the thin film is formed between the transparent substrate and the thin film.

45. (Previously Presented) The photomask blank according to claim 42, wherein a nitride film containing nitrogen and the same transition metal or metals contained in the thin film is formed between the transparent substrate and the thin film.

46. (Previously Presented) The photomask blank according to claim 44, wherein the thin film has an oxygen content that continuously decreases and a carbon content that continuously increases from the thin film surface side to the transparent substrate side, nitrogen is contained in the nitride film in a relatively greater amount than the amount of nitrogen contained in the thin film, and the amount of the transition metal decreases as the amount of nitrogen in the nitride film increases.

47. (Previously Presented) The photomask blank according to claim 31, wherein the thin film contains chromium.

48. (Previously Presented) The photomask blank according to claim 41, wherein the transparent substrate is composed of quartz glass.

49. (Previously Presented) A photomask on which a mask pattern has been formed by the patterning of the thin film formed on the transparent substrate of the photomask blank of claim 31.

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50. (Currently Amended) A method of manufacturing a photomask blank, in which a sputtering target containing one or more transition metals or compounds thereof is disposed in a vacuum chamber into which an atmosphere gas has been introduced, and a thin film having a shading function is formed over a transparent substrate by sputtering,
wherein the formation of said thin film is conducted at a thin film deposition rate in a manner that a particle occurrence frequency dependent on the thin film deposition rate is restrained so that the production yield rate dependent on the particle occurrence frequency is within tolerance.

wherein the correlation between the amount of helium gas contained in the atmosphere gas and the film stress of the thin film is determined before introducing the atmosphere gas into the vacuum chamber,

the helium gas content is determined from said correlation so that the thin film will have a film stress such that the mask pattern obtained when the thin film is patterned will have the desired pattern position precision, and the thin film is formed by sputtering in an atmosphere gas having this helium gas content.

51. (Previously Presented) A method of manufacturing a photomask blank, in which a sputtering target containing one or more transition metals or compounds thereof is disposed in a vacuum chamber into which an atmosphere gas has been introduced, and a thin film having a shading function is formed over a transparent substrate by sputtering,

wherein the thin film is formed at a deposition rate of 0.5 nm/sec to 6 nm/sec, and the atmosphere gas contains helium gas.

52. (Previously Presented) A method of manufacturing a photomask blank, in which a sputtering target is disposed in a vacuum chamber into which an atmosphere gas has been introduced, and at least a thin film having a shading function is formed over a transparent substrate by sputtering,

wherein the thin film is formed at a sputtering power of 950 to 3000 W, and the atmosphere gas contains helium gas.

53. (Previously Presented) The method of manufacturing a photomask blank according to claim 50, wherein the helium gas content is 30 to 90 vol% in the atmosphere gas.

54. (Previously Presented) The method of manufacturing a photomask blank according to claim 50, wherein the helium gas content is 40 to 65 vol% in the atmosphere gas.

55. (Previously Presented) The method of manufacturing a photomask blank according to claim 50, wherein the thin film further contains one or both of carbon or oxygen.

56. (Previously Presented) The method of manufacturing a photomask blank according to claim 51, wherein the thin film further contains one or both of carbon or oxygen.

57. (Previously Presented) The method of manufacturing a photomask blank according to claim 52, wherein the thin film further contains one or both of carbon or oxygen.

58. (Previously Presented) The method of manufacturing a photomask blank according to claim 54, wherein the thin film is a laminated film including a shading layer that contains carbon, and an anti-reflective layer that contains oxygen, and any one or both of the shading layer or the anti-reflective layer is formed by sputtering in an atmosphere gas containing helium gas.

59. (Previously Presented) The method of manufacturing a photomask blank according to claim 54, wherein a nitride film containing nitrogen and the same transition metal or metals contained in the thin film is formed between the transparent substrate and the thin film.

60. (Previously Presented) The method of manufacturing a photomask blank according to claim 50, wherein the thin film is formed by inline sputtering.

61. (Previously Presented) The method of manufacturing a photomask blank according to claim 58, wherein the thin film is formed by inline sputtering.

62. (Previously Presented) The method of manufacturing a photomask blank according to claim 59, wherein the thin film, or the thin film and the nitride film, is or are formed by inline sputtering.

63. (Previously Presented) The method of manufacturing a photomask blank according to claim 50, wherein the thin film further contains chromium.

64. (Previously Presented) The method of manufacturing a photomask blank according to claim 50, wherein the transparent substrate is composed of quartz glass.

65. (Previously Presented) A method of manufacturing a photomask, wherein a mask pattern is formed by selectively removing the film formed on the transparent substrate of a photomask blank obtained by the manufacturing method of claim 50.

66. (Previously Presented) A method of forming a micropattern, in which a fine pattern is formed over a substrate by photolithography,

wherein the photomask according to claim 49 is used as a mask in transferring the fine pattern.

67. (New) The photomask blank according to claim 32, wherein said deposition rate during the film formation by the sputtering is 0.5 nm/sec to 6 nm/sec.

63 68. (New) A photomask blank forming a thin film having a shading function and containing one or more transition metals or compounds thereof on a transparent substrate,

wherein the film stress of said thin film is restrained in a small value by containing He (helium), and the thin film has a crystal grain size of 1 to 7 nm. ←

69. (New) A photomask blank forming a thin film having a shading function and containing one or more transition metals or compounds thereof on a transparent substrate,

wherein the formation of said thin film is conducted at a thin film deposition rate in a manner that a particle occurrence frequency dependent on the thin film deposition rate is restrained so that the production yield rate dependent on the particle occurrence frequency is within tolerance,

the film stress of said thin film is restrained in a small value by containing He (helium), and

the helium gas content is determined so that the thin film will have a film stress such that the mask pattern obtained when the thin film is patterned will have the desired pattern position precision.

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70. (New) A method of manufacturing a photomask blank, in which a sputtering target containing one or more transition metals or compounds thereof is disposed in a vacuum chamber into which an atmosphere gas has been introduced, and a thin film having a shading function is formed over a transparent substrate by sputtering,

wherein the formation of said thin film is conducted at a thin film deposition rate in a manner that a particle occurrence frequency dependent on the thin film deposition rate is restrained so that the production yield rate dependent on the particle occurrence frequency is within tolerance, and

the He gas content is 30 to 90 vol% in the atmosphere gas.